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GEOGRAPHICAL NOTES.—M. Desiré Charnay has returned to France from his travels in Yucatan, where he has studied the ruins of Aké, Chichenitza and other cities. Aké is one of the oldest centers of the peninsula, and contains from eighteen to twenty pyramids, which, with what remains of their superstructure, belong to the early "cement" epoch of Toltec architecture. M. Charnay does not credit the great age some attribute to Toltec remains, but believes those of Yucatan not to antedate the commencement of the fifteenth century. Chichenitza is of hewn stone, and is more modern than Aké. Near the junction of the Mexican provinces Chiapas and Tabasco with Guatemala, M. Charnay found the remains of a center not before known except to the mahogany-cutters, and named it "Lorillard City," after the well-known P. Lorillard, who partially defrayed the expenses of the expedition. The ruins greatly resemble those of Palenque.——Colonel Prejevalsky is superintending the printing of the account of his third journey, which is promised to appear before he sets out upon his fourth expedition, which will be in March of this year.——The Swedish expedition to Spitzbergen, under the leadership of Baron G. de Geer and Herr Nathorst, has furnished maps which give the outlines of the fjords and valleys of the southern part of that island, and the relative depths of the sea around it and Scandinavia. A comparatively level plateau extends between these two lands, which may be considered as ridges rising from it. West of Spitzbergen this plateau sinks abruptly into the ocean. The mountain sculpturing of Spitzbergen is due to the action of glaciers during the glacial epoch, after which a subsidence occurred, followed by a considerable elevation, proved by the existence of gravel beaches and marine beds far inland. The plants and animals of the island are Scandinavian, and this fact, as well as the fossils present, point to a probable former land connection along the line of the plateau, causing the Gulf Stream to bathe the western coasts of Spitzbergen and give it a milder climate than at present.

GEOLOGY AND PALÆONTOLOGY.

INTERMITTENT WELLS IN NEBRASKA.—In the neighborhood of Shelby, Polk county, Nebraska, are many wells which exhibit peculiar phenomena of intermittence. The wells of the district vary from 100 to 140 feet in depth, and ebb and flow irregularly. The flow is accompanied by a roaring sound like that of the sea, as though a distant wave were coming in, and at the same time a current of air issues out of the mouth of the well. The ebb is accompanied by a draft of air downwards into the well.

The period of ebb and flow does not appear to depend upon heat or cold, upon the dampness or dryness of the atmosphere, upon the season of the year, or upon the time of day; but, on the other hand, seems to be in some way connected with the direction of the winds. When the wind blows from the south, south-east or south-west, the phenomena of flow occur, while the ebb is synchronous with a north, north-east, or north-west wind. The roaring sound before mentioned, is observed to occur some time before the wind commences to blow. One of these intermittent wells, 113 feet in depth, is situated upon the farm of George Bull, at Shelby, seventy miles from Lincoln. Similar wells occur in the adjoining county of Butler.

We, the undersigned, certify that the above statements are correct:

JAMES MACKIE,
J. D. COERY,
R. SIZER,
T. COWAN,
JACOB SCHMID,
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LEVI CUNNINGHAM,
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Address any of the above at Shelby, Polk county, Neb.

[It is further stated that the wells above mentioned only pass through "soil" (probably the loess) and reach water at its bottom, which rests on a bed of gravel. The farmers of the region in question think that this water-bearing level is identical with that of the water of the Platte river, which bounds those counties on the north.—*Eds.* NATURALIST.]

LYDEKKER ON INDIAN MAMMALIA.—Two new parts of the Palæontology of the Geological Survey of India have come to hand. These include synopses of the extinct Rhinoceroses and horses, and additions to the Proboscidia. The descriptions and figures are welcome, and indicate again the richness of the tertiary Indian fauna, and the large size of many of the species. We must take exception to Mr. Lydekker's systematic ideas. He discards most of the genera of the Rhinocerontidæ, adopting only two, Aceratherium and Rhinoceros. The only difference between these is the absence and presence of the nasal dermal horns, a character no better or more constant than various others, which he ignores. Aphelops is united with Aceratherium, although it has three digits in the manus while Aceratherium has four, because the "number of digits can rarely be ascertained!" He objects to Cope's dental formula for incisor teeth of the restricted genus Aceratherium as being inaccurate. Had Dr. Lydekker been acquainted with the American species referred to that genus at the time of writing, he would have discovered that the diagnosis is correct as applied to them. The American forms, *A. mite* and *A. nebrascense*, have since been separated under the generic head Cœnopus. Dr. Lydekker cannot discuss the American species of Aphelops, "because no figures of the crania have been given." Good figures of three of the species will be found in the NATURALIST, 1879, p. 771c et seq.

In the horses, Hippotherium is placed in the Equidæ, Dr. Lydekker evidently attaching more importance to the presence of cementum on the molars, than to the number of toes. Protohippus is not referred to. Hippidium is united with Equus, a course which future discovery may sustain.—*E. D. Cope.*

THE ANCESTOR OF CORYPHODON.—In describing the genus *Pantolambda* I remarked that it was " founded on a mandibular ramus, which supports the first true molar, and the last two premolars. The characters of these teeth remarkably resemble those of Coryphodon. * * * It will be for additional material to demonstrate whether this genus belongs to the Amblypoda or Perissodactyla."

A considerable part of the skeleton of *Pantolambda bathmodon* having been recently sent me by Mr. D. Baldwin, I am able to throw much light on the affinities of this curious animal.

In the first place, the phalanges (with ungual), show that the genus is ungulate. Secondly, the astragalus has a large distal facet for the cuboid bone. This proves that the genus cannot be referred to the Taxeopod order. The question as to whether it belongs to the Amblypoda or the Diplarthra would be decided by the carpus, but that part is unfortunately not preserved, and I have to rely on empirical indications for a provisional determination. Apart from the astragalus, the characters are those of the Condylarthra rather than of the Perissodactyla, and it is therefore to be supposed that the carpus has also the characters of that order. This would place the genus in the Pantodonta, which has the carpus nearly that of the Taxeopoda, and the tarsus of Diplarthra. The points of resemblance to the Condylarthra are the following: The ilium is narrow. The humerus has an epitrochlear canal. The superior molar teeth have but one internal lobe. The resemblances to the Pantodonta are these: The cervical vertebræ are plane and short. The femur has a third trochanter. The premaxiliary bone is dentigerous. The astragalar trochlea is as in the Periptychidæ, and the Proboscidia; that is, without groove, and slightly convex anteroposteriorly, thus differing from that of the Pantodonta. The dentition is especially like that of the Amblypoda in general, and that of the superior series is unlike anything known in the Diplarthra.

I propose to place this genus in the Amblypoda for the present, next to the Pantodonta, but it cannot enter that sub-order on account of the form of its astragalus. The sub-orders of Amblypoda will be defined as follows:

Astragalus with a head distinct from trochlea, with distal articular facets..*Taligrada.*
Astragalus without head; distal facets subinferior..................*Pantodonta.*

In the sub-order Taligrada, the single family *Pantolambdidæ* presents the following characters:

Superior and inferior molars with the cusps developed into Vs.

Postglenoid process present; posttympanic and paroccipital not distinct. All the vertebræ with plane articulations. Humeral condyles without intertrochlear ridge. Femur with third trochanter. Digits of posterior foot probably five. Metapodial keels small and posterior.

Of this family Pantolambda is as yet the only known genus. Its leading cranial characters are as follows:

Canine teeth large; dental series continuous. Superior molars all triangular, that is with a single internal cusp. External cusps of premolars unknown; of molars two. Internal cusp V-shaped, sending its horns externally as cingula to the anterior and posterior bases of the external side of the crown, without intermediate tubercles. Inferior true molars with a crown of two Vs, the anterior the more elevated. Premolars consisting of one open V, with a short crest on a short heel, as in Coryphodon. Dental formula I. $\frac{?3}{3}$; C. $\frac{1}{1}$; P-m. $\frac{?4}{?4}$; M. $\frac{3}{3}$; the last inferior with a heel. A strong sagittal crest. Auricular meatus widely open below. Large postparietal, postsquamosal and mastoid foramina.

The brain case indicates small and nearly smooth hemispheres, extending with little contraction into a rather large cerebellum. The olfactory lobes are produced anteriorly at the extremity of a rather long isthmus.

If we consider the dentition alone, Pantolambda is the ancestor of Coryphodon. The history of the feet requires further elucidation.

The *Pantolambda bathmodon* is about as large as a sheep, and comes from the upper beds of the Puerco.—*E. D. Cope.*

NOTE ON THE TRITUBERCULATE TYPE OF SUPERIOR MOLAR AND THE ORIGIN OF THE QUADRITUBERCULATE.—It is now apparent that the type of superior molar tooth which predominated during the Puerco epoch was triangular or tritubercular; that is, with two external, and one internal tubercules. Thus of forty-one species of Mammalia of which the superior molars are known, all but four have three tubercles of the crown, and of the remaining thirty-eight all are triangular excepting those of three species of Periptychus, which have a small supplementary lobe on each side of the median principal inner tubercle.

This fact is important as indicating the mode of development of the various types of superior molar teeth, on which we have not heretofore had clear light. In the first place, this type of molar exists to-day only in the insectivorous and carnivorous Marsupialia; in the Insectivora, and the tubercular molars of such Carnivora as possess them (excepting the plantigrades). In the Ungulates its persistence is to be found in the molars of the Coryphodontidæ of the Wasatch, and Dinocerata of the Bridger Eocenes. In later epochs it is chiefly seen only in the last superior molar.

It is also evident that the quadritubercular molar is derived from the tritubercular by the addition of a lobe of the inner part of a cingulum of the posterior base of the crown. Transitional states are seen in some of the Periptychidæ *(Anisonchus)* and in the sectorials of the Procyonidæ.—*E. D. Cope.*

GEOLOGICAL RELATIONS OF CAMPBELL ISLAND.—M. H. Filhol, in a note read before the Academy of Sciences, Paris, February, 1882, takes occasion to doubt whether this island at any time formed part of New Zealand, as is supposed by some of those who believe in the great extension of the last-named land in recent geological times. M. Filhol does not call in question the existence of a continental New Zealand, but states that Campbell island consists chiefly of a limestone containing Globigerina, and of lavas containing anorthite, and that neither of these rocks occur in New Zealand. The limestone is of deep-sea formation, and the lava must, from the presence of anorthite, be Post-pliocene. The lava was therefore erupted, and the island elevated, at the period when New Zealand possessed its least geographical extension. Moreover, neither moas nor lizards have been found on Campbell island.

THE PRINCETON SCIENTIFIC EXPEDITION OF 1882.—This expedition, consisting of some professors and six students of Princeton College, left Princeton June 26 and remained in the field until September 6th. The object of the excursion was a geological one, and the fields operated in were Chalk bluffs, Colorado, and Bad lands of Dakota. A thousand miles of riding was accomplished, many photographs were taken, and nearly a ton and a-half of fossils, including more than twenty-six genera of mammals and reptiles, were collected for the museum.

GEOLOGICAL NEWS.—*Silurian*—Dr. T. Davidson lists the Silurian Brachiopoda, of Scotland, 134 species, of which sixty-four are recorded from the Llandeilo; forty-four from the Caradoc, forty-seven from the Llandovery, eight from the Wenlock and twenty-eight from the Ludlow.——Dr. Nathorst writes to the *Geological Magazine* to throw doubt upon the "plant-fossils" recently described from the Silurian of Central Wales. With regard to Retiofucus, the vegetable nature of which, according to the describer, cannot be doubted, Dr. Nathorst states that he has seen a similar structure produced by the bursting of foam-bubbles of dirty sea-water upon the beach. These so-called fossils are all described as convex projections from the under side of the grit beds. They cannot therefore, says Dr. Nathorst, be plant fossils, but are for the most part simply *casts* of the depressions made by the trails of animals.——G. R. Vine describes thirteen species of tubicolous annelids from the Wenlock shales, (Silurian), most of them new.——J. E. Marr describes the Cambrian and Silurian rocks of Scandinavia. There is a most important physical break, as indicated by the absence of several beds at the summit of the Cambrian; and there is a palæontological break, most marked in the deep-water beds.——Professor J. D. Dana writes upon the geological age of the "Taconic system" of the Taconic mountains of New England, and maintains that the Stockbridge limestones are conformable with the central schists.

Carboniferous.—M. Brongniart (*Comptes Rendus*) describes a remarkable Orthopteron of gigantic size, found in blackish shales of Coventry, France. The insect is nine and a-half inches long, and is well furnished with spines. It was probably apterous. Until 1882 only 110 species of insects were known from the Carboniferous rocks of the whole world, none of them from France, but since that date 430 impressions have been obtained from Coventry.——In the Quarterly Journal of the London Geological Society, E. W. Binney writes upon a series of red barren beds overlying the profitable beds of the Fifeshire coal-measures. These beds are higher than any on the east coast of England, and may be the entire or partial equivalents of the upper coal-measures of the western districts. Fish, crustacea, calamites, algæ, etc., occur.——P. H. Carpenter works out the relationships of the genera Hybocrinus, Bærocrinas, and Hybocystites. The first he regards as a Crinoid of a very embryonic type, the second as a permanent larval form which has only developed three of its five arms, and the last as combining the characters of the Blastoidea with those of the Crinoidea.——W. H. Twelvetrees (*Geol. Mag.*, Aug., 1882), has a note on some reptilian teeth from the upper Permian cupriferous sandstones of Kargalinsk, near Orenburg, Russia, including a canine belonging to an unknown species, a tooth which he probably erroneously supposes to be an incisor of Deuterosaurus, and a curved sabre-like tooth with crenated edges, which the writer suggests may belong to a true Dinosaur. All reptilian Permian remains, hitherto found in Russia, have been Theromorphous.——Professor Cope recently exhibited at a meeting of the Philadelphia Academy, crania more or less complete, of four species of a genus of Permian Theromorphous Saurians with molar teeth, which he had named *Empedias.* The species are *E. latibuccatus*, *E. phaseolinus*, *E. molaris* and *E. fissus*, sp. nov. The first named approaches the genus *Chilonyx* in the presence of swollen areæ on the top of the skull. The others form a series beginning with *E. phaseolinus* with more numerous, narrower teeth, to *E. fissus* with fewer, wider teeth.

Triassic.—Joaquin Gonzalo y Xavier has communicated to the London Geological Society the discovery of fossils in the metalliferous limestone of the Sierra de Gador, Spain, hitherto a puzzle to geologists. The fossils prove the strata to be Triassic.

Cretaceous—W. Whitaker (*Geological Magazine*) writes of the Red Chalk of Norfolk, which has been variously supposed to belong to the Chalk, Upper greensand or Gault, or to some combination of these. His conclusion, from palæontological evidence, is that it represents the lowest part of the Chalk, the Upper greensand and the upper part of the Gault.——Mr. Woodward describes a Calamary (*Dorateuthis syriaca*) from the cretaceous of Sahel Alma, near Beirut, Lebanon, Syria. The limestone in which this was found has yielded many other interesting forms, including a Squilla, a Limulus, and several undescribed Crustacea. The pen; arms, short and long; the outlines of the fins, position of the ink-bag, impression of the horny mandibles, and the eyes, can be well seen in the fossil.——Professor Seeley also describes a dinosaurian coracoid found at Brook, Isle of Wight. If this bone pertains to a described genus, it must be to Pelorosaurus or Ornithopsis. It is 17⅓ inches long, and 14¼ wide.

Tertiary—Dr. Manzoni has published a memoir upon the siliceous sponges of the Middle Miocene of Bologna and Modena. The Lithistid and Hexactinellid sponges of some layers are so numerous that these may be regarded as sponge-beds. A remarkable fact is that these sponges occur in a stratum which, from its structure and the included Echinoderms and Mollusca, is proved to be of comparatively shallow water origin.——Professor Owen describes the femur of *Nototherium mitchelli*, an extinct Australian marsupial, probably in some respects intermediate between the wombat and the kangaroo.

Quaternary—Professor Nordenskiöld, on his return from his voyage around Siberia, discovered at Moji, near Nagasaki, Japan, a rich flora of late Tertiary or Post-tertiary age. These plants include about seventy species of trees and shrubs, constituting an assemblage very similar to that which now inhabits the forest regions of the northern portions of Japan, at heights of 4500 to 7000 feet. When this fossil flora grew in the extreme south at the sea-level, the climate must have been colder than now. By far the greater number of the genera now occur in this country, and from eighty to ninety per cent. of the leaves cannot be distinguished from those of *Fagus ferruginea*, to which an existing Japanese beech is very close.——In a late communication to the Geological Society, the Rev. A. Irving brings many arguments against the supposed excavating powers of glaciers. He asserts that the facts show that most of the energy developed is expended within the mass of the glacier in overcoming cohesion, having only a small residuum for erosion, This is borne out also by the absence of ductility and lack of continuity shown by crevasses. Much of the erosion attributed to glaciers is really caused by the direct action of glacier streams. Some basin-like hollows may have been formed by glaciers, but many lakelets occupy hollows formed by earth-movements on the mountain-slopes or by moraines. Among the causes producing valley-lakes Mr. Irving enumerates *alterations in the relative levels* of different parts of the floor of a valley; *upthrust* of the more yielding strata by the resolution of forces due to pressure of the mountain-masses, and the *crushing in of the floor* by the dead weight of the huge glaciers piled upon it. Faults and chemical solution also played their parts. The writer thought that the greater abundance of lakes in glacial countries was largely due to the better preservation of their basins from silting. In some glaciated regions lakes are wanting.——In the *Geological Magazine* for January, Mr. H. H. Howorth continues his perennial argument in favor of a great Post-glacial flood. He asserts that the number of purely Arctic shells found in the marine drift is comparatively small, while several shells of a southern origin occur, and both are often broken, and clearly not *in situ*. This is the case in Norway and Sweden, as well as in England and Ireland. ——E. L. Jones gives the results of the exploration of two caves near Tenby, Wales. One of these contained remains of the mammoth, rhinoceros, hippopotamus, hyæna, elk, Irish elk, *Bos priscus*, cave lion and cave bear, while all these palæolithic animals were wanting from the other, which yielded the reindeer, red-deer, horse, hog, *Bos longifrons*, and dog or wolf. In the second the remains of a hearth were also found. The first was a palæolithic hyæna-den, the second a neolithic human residence.

General—The long-delayed Geological Record for 1878 has at length appeared. Its editor explains the delay by the non-arrival of the sections on America and the Arctic regions, without which important portions the work has finally been issued. Supplements for 1874-1877 follow each of the main divisions.——Mr. R. P. Whitfield contributes to the Bulletin of the American Museum of Natural History, illustrations of the species previously described in the Trans. Albany Institute, by Professor James Hall, with a revision of the descriptions hitherto published and diagnosis of three new species.——A. M. Waters describes fossil chilostomatous Bryozoa from Mount Gambier, S. Australia, giving notes of sixty-eight species, thirteen of which are new.——J. Milne, in the Transactions of the Seismological Society of Japan, gives some interesting particulars as to the effect of earthquakes upon buildings. Three hundred and seventy earthquakes, occurring from 1872 to 1880 inclusive, gave ample opportunity for such observations. Brick houses in streets running S. W. to N. E. have been much more cracked than those in streets at right angles to this direction. The most and more intense shocks traveled S. E. to N. W. Cracks in buildings which did not lengthen, were yet found by indicators to open and shut, and Mr. Milne discusses the possibility of erecting buildings with joints ready made, so that portions of a structure likely to have different periods of vibration may oscillate independently. Chimneys are, in Yokohama, often built free from the roof for this reason. Arches which curve into their abutments are less likely to crack than such as join them at an angle. The majority (213) of the shocks came in the winter.

BOTANY.[1]

THE MOVEMENTS OF ROOTS OF INDIAN CORN IN GERMINATION.[2]—In the recent work of the late Charles Darwin on the movements of plants, he says that roots, stems and leaves bend to all points of the compass successively with a sort of rolling motion which he terms circumnutation—a bowing around

The radicle bends away from any irritant, as a small piece of gum paper attached to one side of the tip. "In whatever direction the primary radicle [or root] first protrudes from the seed, geotropism guides it perpendicularly downwards."

I have carefully studied the movements of some 400 or more kernels of sprouting Indian corn of seven or more varieties, and, so far as they are concerned, Darwin's statement is much too strong in regard to geotropism guiding the radicles perpendicularly downwards. If allowed to germinate on a flat, smooth plate, some of the roots will rise and fall as they move along the surface, making a series of curves, others continue to run flat on the surface, others bend the tip of the root against the plate and curve with so much force that the kernel is tipped over. On a piece of thick, wet paper, the root is often slightly obstructed so that it makes a coil and proceeds forward again.

One of my students repeated some of Darwin's experiments by pinning kernels of germinating corn on a cork, over water in a bottle set in a dark place. Pieces of gum-paper were placed on one side of the tips of the roots. In some cases the root was a trifle deflexed from the paper, in others it was not in the least changed in its course. In some cases single coils were made; in one instance a figure 8 was made and a single coil after that, by which the gum-paper was shoved off, when the root went straight on to the water. It was not sensitive to another paper on the tip. Another root almost tied itself into a knot. Young roots were the most sensitive.

I pinned over 300 kernels of germinating corn to small sticks, which were placed over water in a deep pan, and all closely covered in the dark. Seven varieties of corn were used, some of which were fresh; some of which had been grown some years before. No gum-paper or other objects were placed on any of these roots. It seemed to make little difference which side or which edge or end of the kernel was placed uppermost, the results were equally variable, so far as the direction taken by the roots was concerned. In all of the sorts, one or more coils were very common. One root went off without support in a horizontal direction for three

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[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

[2] Notes from papers presented at the Cincinnati and the Montreal meetings of the American Association for the Advancement of Science.